



Target Acquisition Weather Software (TAWS)

Illumination Analysis
Target Acquisition Analysis



Introduction



- The Target Acquisition Weather Software (TAWS) is designed to help the forecaster assist the customer to determine impacts that weather may have on the use of Target Acquisition Systems (TAS) and the employment of Precision Guided Munitions (PGM)
 - This software predicts the performance of air-to-ground EO weapon and navigation systems.
 - Performance is expressed primarily in terms of maximum detection or lock-on range



**SELECT
"DEFAULTS"**



Default Values



- Setting up default values is not something you will do every time you run the program, and may be something you do only once.
- Set the units you are most comfortable with that meet the needs of you and your customer
- You can change units at any time
- If you select SAVE, all defaults will be saved for future missions
- If you select APPLY, the defaults will only be applied to the current mission



Illumination Analysis



- Involves the computation of solar and lunar ephemeris information for a specified location and a series of dates and times.
- Weather conditions are not taken into account
- A dialog box will appear once the Illumination Analysis option has been chosen
- Three main steps in conducting the analysis
 - specify station name and time information
 - run the analysis
 - view the results either in tabular or graphic mode



**SELECT
"ILLUMINATION
"**



Illumination Analysis

Station

Load Save **Search DAFIR**

Analyze Solar/Lunar

Events Positions

Results

View Graph View Table

Station Properties
Name: OFFUTT AFB
Latitude: Deg: 41 Min: 7 ☒ N ☐ S
Longitude: 95 54 ☐ E ☒ W

Start Date
November 1999

S	M	T	W	T	F	S
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4
5	6	7	8	9	10	11

Timezone Offset from UTC:
Hour: -06 Min: 00
Days to Display: 1

Analysis Properties...

Done



Station and Time Information



- Station Name
 - A name you chose to identify this station
 - Does not affect the output
 - Name identifies this location in the software if you want to save it for future use
 - No limit to the number of characters
 - Camp Shelby
 - Bright Star



Entering Illumination Values



- Latitude/Longitude
 - This option will only appear if the default value for earth location has been set to deg/min
 - Click on the arrows in the spinner boxes or type in the values. Select N or S, E or W
- MGRS
 - This option will only appear if you have selected MGRS as the default value for “earth location”
 - Click on the box and enter the full MGRS reference
- Timezone Offset
 - Number of hours difference between local time and UTC
 - Use (-) for west longitude and (+) for east longitude
 - Shaw AFB: -5 Kuwait: +3



Illumination Values



- Start Date
 - The default date is taken from your computer system clock
 - Change the month and year with the pull down menus
 - Change the day by clicking the appropriate number on the calendar
- Days to Display
 - Minimum is 1 and Maximum is 31
- The "Save" option will save the data to the software under the station name you entered
- Can be recalled later by clicking on "Load"



Analysis Data



- Chose either “Events” or “Position”
 - “Events” Analysis
 - Will compute SR, SS, MR, MS, BMNT, EENT
 - The Start time is either noon or midnight depending on the default setting
 - The data will be displayed in either local time or UTC depending on the default setting
 - “Position” Analysis
 - Calculates solar and lunar elevation and azimuth angles
 - Calculates lunar illumination and ground illumination
 - The default settings control start time and time interval



View Results



- Results can be viewed in either a Tabular form (View Table) or a Graph (View Graph)
 - The ground illumination value does not take weather conditions into account
 - Twilight
 - When sun angle is between 0 and -12
 - BMNT
 - Time when the rising sun angle reaches -12
 - EENT
 - Time when the setting sun angle reaches -12



Graph Output



- Portions of the day when the sun is above the horizon is shaded in Yellow
- Nautical twilight is shaded in Gold
 - Twilight: sun angle between 0 and -12
- Times when the moon is above the horizon are shaded in Gray
- Times when the moon is below the horizon are shaded in Black



Target Acquisition Analysis



- The Target Acquisition Analysis involves the computation of detection and lock-on range for a particular target at a particular location under specified weather conditions
- Two options with target acquisition analysis
 - Single Point-Based Analysis
 - Multiple Map-Based Analysis



**SELECT
"SINGLE POINT"**



Single Point-Based Analysis



- The Point-Based Target Acquisition Window gives you access to all required input parameters and output products
- Five main steps
 - Specify Target Information
 - Specify Operations, or Sortie, Information
 - Specify Weather Information
 - Run the Analysis
 - View the Results
 - Tabular form of Graphic form



Point-based Target Acquisition

Target / Background...	Default Runway - Concrete 30° 25' N 086° 41' W Vegetation	Analyze...
Ops...	LASER @ 2000 ft TOT: 28 Sep 1999 1333 UTC	Results
Weather...	Wx Source: User	View Graph...
		View Table...

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**SELECT
"TARGET/BACKGROUND
"**



Target Information



- The TAWS program does not have the capability to build or modify targets at this time
- To specify target information click on Target/Background
- Latitude/Longitude
 - The default value must be set for lat/lon for this option to appear
 - Click on the arrows in the spinner boxes or type in the values. Select N or S, E or W
- MGRS
 - This option will only appear if you have selected MGRS as the default value for "earth location"
 - Click on the box and enter the full MGRS reference



Target Information



- Elevation
 - MSL altitude of the target location.
 - The software only uses this information to compute data for IR sensor systems.
- Clutter/Complexity
 - Describes, in general terms, the number of objects in the target scene that can be mistaken for the target
 - Target detection range increases with decreasing clutter
 - The software only uses this information to compute data for IR and NVG sensor systems.



Target Information



- Albedo
 - Describes primary earth surface material in the general target area
 - The default setting for general surface albedo is not always accurate. Discuss this feature with Intel
 - Continental, Urban, Desert, Ocean, Snow
- Surface Background
 - Describes the surface material immediately surrounding a target
 - Can enter up to three backgrounds
 - Each background has several options to further describe the choice
- Slope/Direction
 - This parameter is only used with TV/NVG sensor systems
 - Describes the slope of the surface background
 - Describes the direction to which the background is sloping down



Target Information



- Specify a target
 - Activate the Add Target window
 - Choose target type
 - Vehicular, Stationary, Other
 - Can choose as many targets as you wish
- Specify target properties
 - highlight a target in your list of targets
 - specify the parameters for each target



Target Parameters



- ID
 - A name you give to the target. Optional
- Comments
 - Identifying information about target. Optional
- Heading
 - Direction the front of the target is facing
 - Front is defined as the width for targets that do not have an obvious "front". (runways)
- Orientation
 - Position of the target relative to a sloped background
 - Used only with the TV/NVG sensor systems
 - At the base of the slope or on the slope itself



Target Parameters



- Operating State
 - Expected operating state of the target
 - Only used with IR sensor systems
 - Only used with the generator, vehicular and helicopter targets
 - Off (cold target, engine is cold and friction points are cold)
 - Idle (engine running or recently shut down, and stationary)
 - Exercised (engine running or recently shut down and friction points are hot)
 - Not required for the F-4 or Ship targets



Target Parameters



- Speed
 - The speed of the target in the direction of the target heading
 - Only used with the IR sensor system
 - accounts for the cooling affect of wind and motion
 - Only used with a vehicular target that has an operating state of "exercised"
- Material/Length/Width
 - These parameters only entered for a customized runway
 - asphalt or concrete
 - length of runway
 - width of runway



Point-based Target Acquisition

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Ops...	LASER @ 2000 ft TOT: 28 Sep 1999 1333 UTC	Results
Weather...	Wx Source: User	View Graph...
		View Table...

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**SELECT
"OPS"**



Operations Information



- Activate the Sortie Properties window
- Sortie Name
 - A name that you can associate with the sortie (optional)
- Comments
 - Additional comments about the sortie (optional)
- Sensor
 - Identifies the sensor used to detect or lock-on to target
 - any number of sensors can be used for IR/TV and NVG
 - only one laser sensor can be used
 - must specify the laser mode



Operations Information



- Sensor Height
 - The elevation of the sensor; AGL
- Sensor View Direction
 - the azimuth angle toward which the sensor is "looking"
- Date/time over Target
 - Defaults to current date/time from computer clock
 - Modify as needed by using the spinner wheels or typing the information in the blocks



Point-based Target Acquisition

Target / Background...	Default Runway - Concrete 30° 25' N 086° 41' W Vegetation	Analyze...
Ops...	LASER @ 2000 ft TOT: 28 Sep 1999 1333 UTC	Results
Weather...	Wx Source: User	View Graph...
		View Table...

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**SELECT
"WEATHER"**



Weather Information



- Click on the Weather Button in the Point-Based Target Acquisition Window
- Weather information is required for a 30 hour period beginning at 18 hours prior to TOT and ending at 12 hours after TOT
- Five sources of weather data
 - Default (static defaults built into the software) coded in red
 - Copy (data taken from previous location or TOT) coded in black
 - Derived (derived from AFWA data) coded in yellow
 - AFWA (download from AFWA) coded in blue
 - User (entered from user) coded in green



Weather Information



- Surface layer
 - defined from the surface up to the boundary layer height (varies from 100ft to 10,000ft). Separates dirty air from clean air
- Upper Layer
 - defined from the boundary layer height to the top of the atmosphere (15km; ~45,000ft)
- Cloud Layers
 - Allows up to three separate layers
 - uses all three layers even though one or more of the layers may be overcast. Software is sensitive to layers above an overcast
 - Specify any and all information about individual layers



Weather Information



- Temperature
 - Computes a diurnal cycle by assuming a minimum temp occurs at sunrise and a maximum temp occurs at 1400L.
 - This cycle can be edited by clicking the temperature button then clicking on the value to be changed and typing in a new value.
 - This can be done for Dew Point and RH also
 - IR/TV/NVG and Laser models use this data to compute RH which is used, along with the aerosol and visibility input, to derive an extinction coefficient



Weather Information



- Wind Speed/Direction
 - Values displayed for wind direction and speed can be edited by clicking on an existing value for a specific time then entering the new data
 - Wind direction is used by the IR model
 - Wind speed is used by IR/TV/NVG and Laser model
 - wind speeds of less than 10kts are critical to the IR model when it computes cooling affect of the wind
 - accuracy in the range from calm to 10kts can make a noticeable difference in output in the IR model



Weather Information



- Surface visibility values can be edited by clicking on a value and entering the new information
 - Used by the IR/TV/NVG and Laser models
 - The model expects the user to account for restricted visibility associated with precipitation
 - the model will not automatically decrease visibility if precipitation is in the forecast
 - The user must be very accurate with visibility values
 - If you expect visibility of 30 miles then enter 30 miles; not just the normal "7" weather forecasters are accustomed to
 - values range from 0.1 to 100 km. (up to ~60miles)



Weather Information



- To edit precipitation type
 - click on one of the radio buttons for a specific time
 - None, Rain, Snow
 - Precipitation rate will be prompted if the user chooses rain for a precipitation type
 - Remember to account for reduced visibility with precipitation. The software will not do this for you
 - Precipitation is used by the IR/TV/NVG and Laser
 - Precipitation rate is only used by the IR and Laser models



Weather Information



- Surface Aerosol
 - Aerosol is used by the IR/TV/NVG and Laser
 - Describes the primary particulates of the air mass close to the earth's surface at the location of interest
 - Rural
 - Urban
 - Maritime
 - Tropospheric
 - Desert
 - Advective Fog
 - Radiative Fog
 - Navy Maritime
 - Camouflage Smoke



Weather Information



- Battlefield Induced Contaminants (BIC)
 - Used by IR/TV/NVG and Laser model
 - Should be used to describe a persistent pall of smoke and dust covering the area of interest
 - BIC is separate from aerosol selection
 - the aerosol selection should still represent the prevailing air mass
 - BIC and air mass aerosol are combined in the run
- Whenever BICs are used, enter a visibility that you think would be appropriate in the absence of BICs. Otherwise, the effect of BICs will be accounted for twice



Weather Information



- Boundary Layer
 - To edit the boundary layer click on the existing value for the time of interest and type in the new value
 - Used by IR/TV/NVG and Laser models
 - Boundary layer can be thought of as the height that separates the dirty layer from the clean air.
 - Most smog is trapped below the BLH
 - Can range from 100ft to 10,000ft depending on stability



Weather Information



- Upper Layer
 - Edit the upper layer value click on the value for the parameter and time of interest and type in a new value
 - Most forecasters think of the upper layer temperature and dewpoint as the 500mb value
 - Used by IR/TV/NVG and Laser models



Cloud



- TAWS supports up to three separate cloud layers
 - One type for each; Low, Middle, and High
- Edit cloud information by clicking on the cloud level and entering new data for type, amount, and/or height
 - Type (2 basic types for each layer)
 - Low: st/sc or cu/cb
 - Middle: as/ac or ns
 - High: thin ci/cs or thick ci/cs
 - Amount
 - Height (base height)
 - Low: 001 - 065
 - Middle: 065 - 200
 - High: 200 - 450



Analyzing the Target



- Once the forecaster has consistent information, he/she can click on the ANALYSE button
 - If the target location changes or the date/time of TOT changes, a new weather input must be accomplished before an analysis can be run
- There are two options
 - Analyze Over Time
 - Analyze Over View Direction



Point-based Target Acquisition

<input type="button" value="Target / Background..."/>	Default Runway - Concrete 30° 25' N 086° 41' W Vegetation	<input type="button" value="Analyze..."/>
<input type="button" value="Ops..."/>	LASER @ 2000 ft TOT: 28 Sep 1999 1333 UTC	<div>Results</div> <div><input type="button" value="View Graph..."/></div> <div><input type="button" value="View Table..."/></div>
<input type="button" value="Weather..."/>	Wx Source: User	

**SELECT
"ANALYZE"**



Analysis Over Time



- Calculates the detection/lock-on range for various times bracketing the TOT
- Calculations based on one view direction
 - Uses the view direction specified in the Sortie Properties
 - This value can be changed by clicking on the arrows in the box
- Target Analysis Parameters can be changed at this time
 - Click on Analysis Properties button and make changes
 - Click OK to save changes
- Click on Run Model to run the analysis using the specified parameters



Analysis Over View Direction



- Calculates the detection/lock-on range for various view directions. Eight compass points
- Only one TOT is allowed for this type of Analysis
 - This value was specified in Sortie Properties
 - To change this value, click on the spinner box
- Target Analysis Parameters can be changed at this time
 - Click on Analysis Properties button and make changes
 - Click OK to save changes
- Click on Run Model to run the analysis using the specified parameters



View Results



- Results can be viewed in two methods
 - Tabular
 - Click on View Table
 - Graphic
 - Click on View Graph



Tabular Output



- Choose table contents
 - Target
 - Sensor Type
 - Select Table Type
- Click on Generate Table button
 - For a target acquisition analysis over time, the table contains a row of data for each output time
 - For a target acquisition analysis over view direction, the table contains a row of data for each view direction



Graphic Output



- Choose table contents
 - Target
 - Sensor Type
 - Select Plot Type
- Click on Generate Plot button
 - For a target acquisition analysis over time, the graph contains a plot of data for output time
 - For a target acquisition analysis over view direction, the graph contains a plot of data for each view direction
 - Target is at the origin and sensor is "looking in"



**SELECT
"MULTIPLE
MAP"**



Multiple Map-Based Analysis



- Allows the user to to obtain a detection or lock-on range for several targets in a region of interest
- Five Steps
 - Define a region of interest
 - Define a sortie
 - Define weather data
 - Run the analysis
 - View the results
 - tabular or graphic format



Multiple Map-Based Analysis



- Customize a regional map
 - Define the area of interest
 - Specify coordinates
 - Drag and Zoom
- Adding Targets
 - No limit on number of targets
 - Add targets anywhere within the region
 - Specify parameters in the same way as the single based target system



Multiple Map-Based Analysis



- Define Weather Data
 - Must specify weather data for each target location
 - Can copy weather data to all locations
 - Specify parameters in the same way as with the single-based target system



Multiple Map-Based Analysis



- Analyzing Targets
 - This feature is the same as the single-based target system
 - Must specify which target you are analyzing for but the output is the same as the single-based target system